World Academy of Science, Engineering and Technology
International Journal of Energy and Environmental Engineering
Vol:12, No:06, 2018

University Building: Discussion about the Effect of Numerical Modelling Assumptions for Occupant Behavior

Authors : Fabrizio Ascione, Martina Borrelli, Rosa Francesca De Masi, Silvia Ruggiero, Giuseppe Peter Vanoli

Abstract : The refurbishment of public buildings is one of the key factors of energy efficiency policy of European States. Educational buildings account for the largest share of the oldest edifice with interesting potentialities for demonstrating best practice with regards to high performance and low and zero-carbon design and for becoming exemplar cases within the community. In this context, this paper discusses the critical issue of dealing the energy refurbishment of a university building in heating dominated climate of South Italy. More in detail, the importance of using validated models will be examined exhaustively by proposing an analysis on uncertainties due to modelling assumptions mainly referring to the adoption of stochastic schedules for occupant behavior and equipment or lighting usage. Indeed, today, the great part of commercial tools provides to designers a library of possible schedules with which thermal zones can be described. Very often, the users do not pay close attention to diversify thermal zones and to modify or to adapt predefined profiles, and results of designing are affected positively or negatively without any alarm about it. Data such as occupancy schedules, internal loads and the interaction between people and windows or plant systems, represent some of the largest variables during the energy modelling and to understand calibration results. This is mainly due to the adoption of discrete standardized and conventional schedules with important consequences on the prevision of the energy consumptions. The problem is surely difficult to examine and to solve. In this paper, a sensitivity analysis is presented, to understand what is the order of magnitude of error that is committed by varying the deterministic schedules used for occupation, internal load, and lighting system. This could be a typical uncertainty for a case study as the presented one where there is not a regulation system for the HVAC system thus the occupant cannot interact with it. More in detail, starting from adopted schedules, created according to questioner' s responses and that has allowed a good calibration of energy simulation model, several different scenarios are tested. Two type of analysis are presented: the reference building is compared with these scenarios in term of percentage difference on the projected total electric energy need and natural gas request. Then the different entries of consumption are analyzed and for more interesting cases also the comparison between calibration indexes. Moreover, for the optimal refurbishment solution, the same simulations are done. The variation on the provision of energy saving and global cost reduction is evidenced. This parametric study wants to underline the effect on performance indexes evaluation of the modelling assumptions during the description of thermal zones.

Keywords : energy simulation, modelling calibration, occupant behavior, university building
Conference Title : ICEEB 2018 : International Conference on Energy Efficiency in Buildings
Conference Location : Vienna, Austria
Conference Dates : June 14-15, 2018